

Lake Alice

Site Description

Location

Water designation number (WDN)	23-0004-00
Legal description	T116- R48W-Sec. 5,6,7,8,17,18; T116N-R49W-Sec. 1,12 T117N-R49W-Sec. 36
County (ies)	Deuel
Location from nearest town	2.0 miles east of Tunnerville, SD

Survey Dates and Sampling Information

Survey dates	June 25-27, 2013 (FN, GN)
Frame net sets (n)	18
Gill net sets (n)	6

Morphometry

Watershed area (acres)	25,060
Surface area (acres)	≈1,100
Maximum depth (ft)	12
Mean depth (ft)	≈8

Ownership and Public Access

Lake Alice is a meandered lake owned by the State of South Dakota and the fishery is managed by the SDGFP. A single public access site maintained by SDGFP is located on the north shore (Figure 1; Figure 2). Lands adjacent to the lake are owned by the State of South Dakota and private individuals.

Watershed and Land Use

The 25,060 acre Caine Creek sub-watershed (HUC-12) encompasses Lake Alice and is located within the larger South Fork Yellow Bank River (HUC-10) watershed. Land use within the watershed is primarily agricultural including a mix of pasture or grassland and cropland.

Water Level Observations

The Water Management Board established OHWM is 1691.8 fmsl, and the established outlet elevation of Lake Alice is 1689.4 fmsl. On May 15, 2013 the elevation was 1691.6 fmsl, which was higher than the fall 2012 elevation of 1690.8 fmsl, and slightly below the OHWM. On October 7, 2013 the water level remained similar to spring levels with an elevation of 1691.5 fmsl.

Fish Management Information

Primary species	Walleye, Yellow Perch
Other species	Black Bullhead, Bluegill, Common Carp, Green Sunfish, Northern Pike, Rudd, White Sucker
Lake-specific regulations	none
Management classification	warm-water semi-permanent
Fish consumption advisories	none

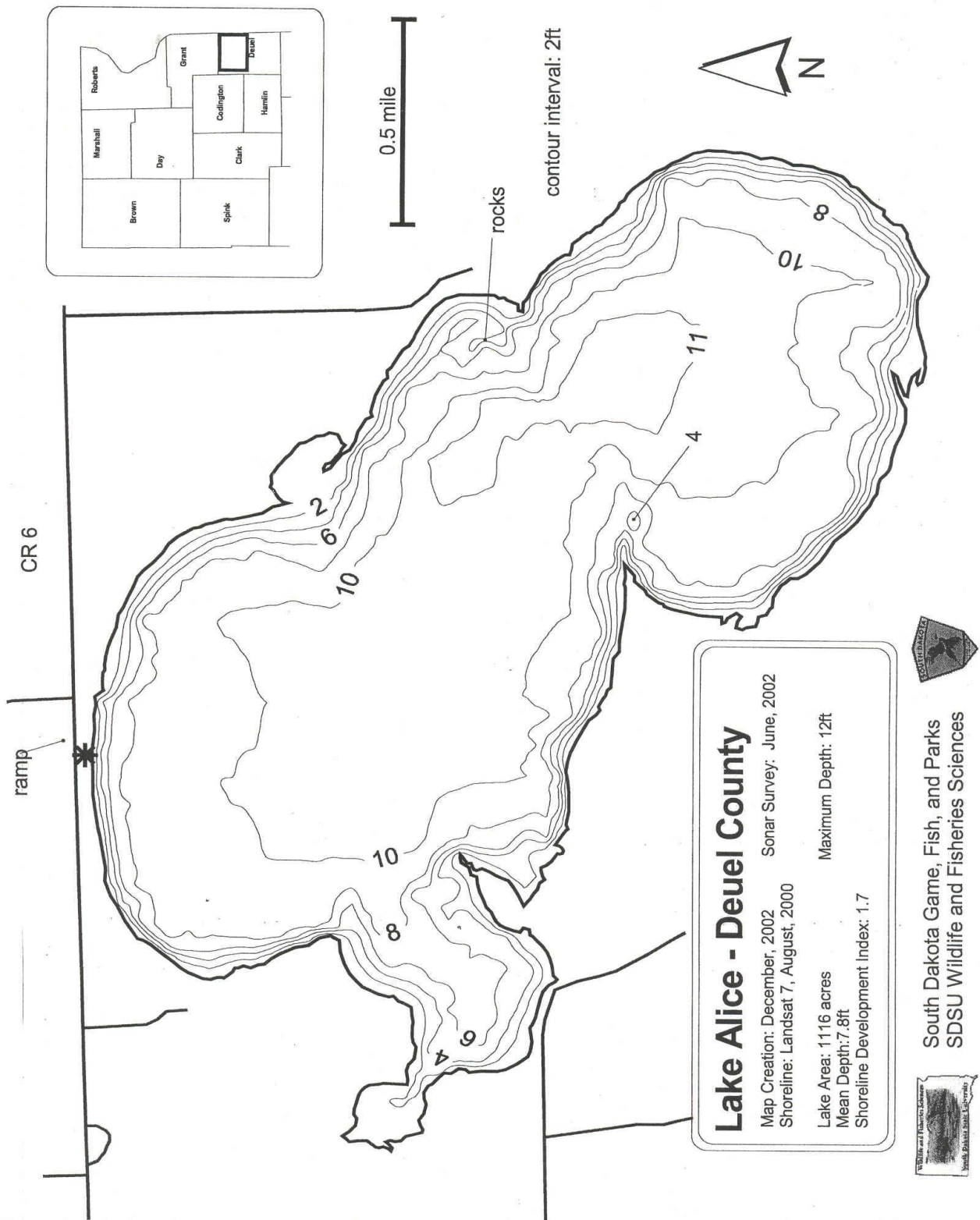


Figure 1. Map depicting the access location and depth contours for Lake Alice, Deuel County, South Dakota.

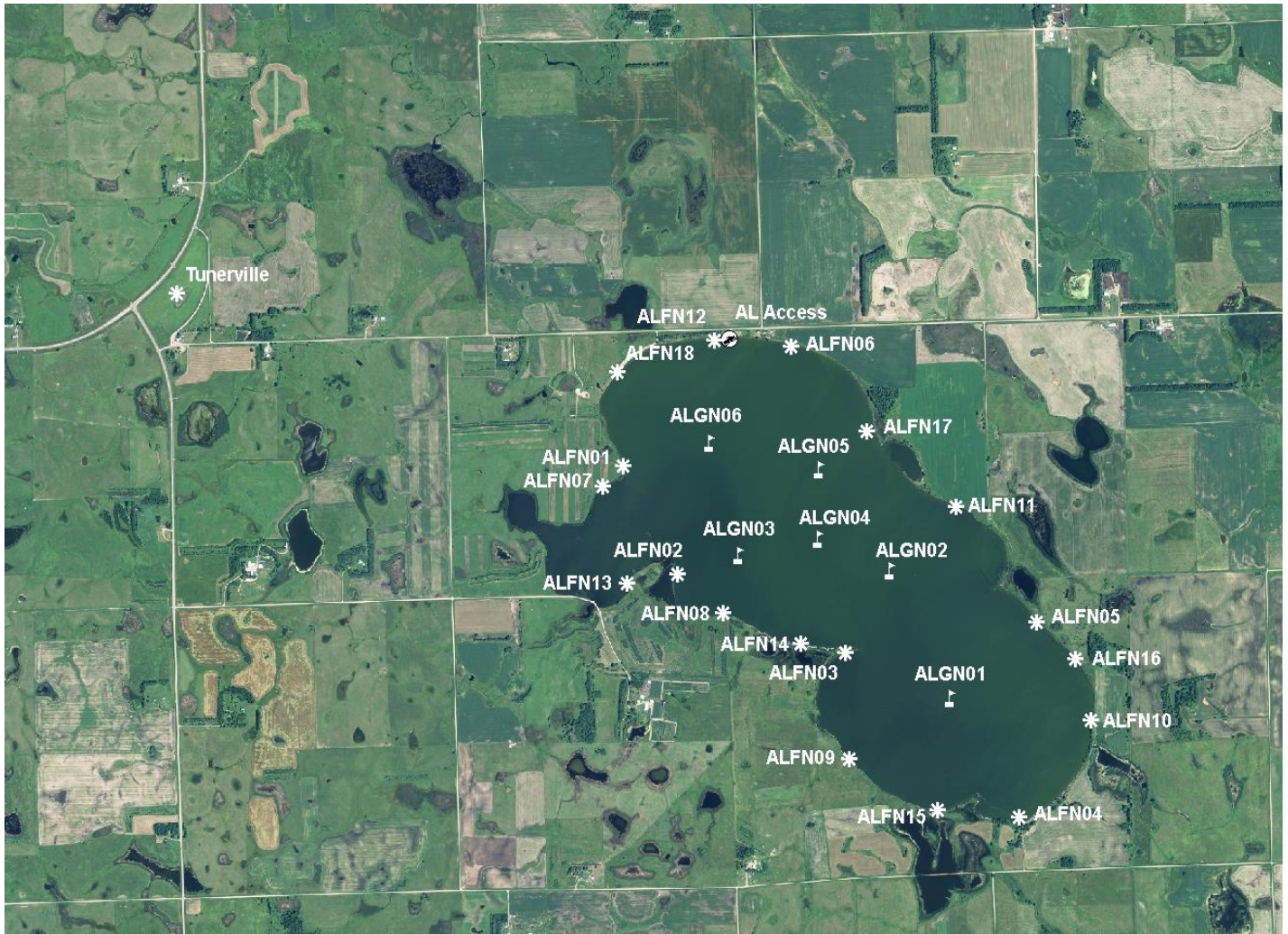


Figure 2. Map depicting geographic location of Lake Alice from Tunnerville, Deuel County, South Dakota. Also noted is the public access location and standardized net locations for Lake Alice. ALFN= frame nets; ALGN= gill nets

Management Objectives

- 1) Maintain a mean gill net CPUE of stock-length Walleye ≥ 10 , a PSD of 30-60, and a PSD-P of 5-10.
- 2) Maintain a mean gill net CPUE of stock-length Yellow Perch ≥ 30 , a PSD of 30-60, and a PSD-P of 5-10.
- 3) Maintain a mean frame net CPUE of stock-length Black Bullhead ≤ 100 .

Results and Discussion

Lake Alice is a relatively-shallow natural lake located in Deuel County, South Dakota. The only tributary to Lake Alice is located on the western end of the lake. A single outlet is located in the northwest corner and drains into Conner Slough eventually emptying into the Minnesota River (Kruger and Kniss 2002).

From 2003-2005, the standard fish community assessment surveys were conducted during early-June. However, heavy algal build-up was forming on gill nets during this time reducing sampling effectiveness. Since 2007, standard fish community assessments have been conducted during late-June or early-July to avoid the heavy algal build-up and provide a sample more representative of the at-large fish community. Currently, Lake Alice is managed as a Walleye and Yellow Perch fishery.

Note: Curlyleaf pondweed and European Rudd are invasive species present in Lake Alice. Care should be taken by all user groups to prevent the spread of these species to other waterbodies. Information about curlyleaf pondweed, European Rudd and how to prevent the spread of invasive species is available at:

<http://gfp.sd.gov/wildlife/nuisance/aquatic/default.aspx>

Primary Species

Walleye: The mean gill net CPUE of stock-length Walleye was 13.0 (Table 1) and above the minimum objective (≥ 10 stock-length Walleye/net night; Table 3). The 2013 mean gill net CPUE represented a substantial increase from the 2010 CPUE of 0.8 (Table 2) and indicated high relative abundance.

Gill net captured Walleye ranged in TL from 30 to 70 cm (11.8 to 27.6 in; Figure 3). The majority, which belonged to a single strong year class (2009), ranged in TL from 42 to 51 cm (16.5 to 20.1 in; Table 4). The PSD was 97 and above the management objective of 30-60; while the PSD-P was 8 and within the management objective of 5-10 (Table 3).

Otoliths were collected from a sub-sample of gill net captured Walleye and age estimates suggested the presence of four year classes (2004, 2005, 2009 and 2011); all of which, coincided with stocked years (Table 4; Table 6). As mentioned previously, the 2009 cohort dominated the gill net catch comprising 92% of Walleye sampled (Table 4).

In 2013, the weighted mean TL at capture for age-4 (2009) cohort was 470 mm (18.5 in; Table 5). The majority of Sampled Walleye were in the quality-preferred length category, which had mean Wr of 95.

Yellow Perch: The mean gill net CPUE of stock-length Yellow Perch was 49.8 (Table 1) and above the minimum objective (≥ 30 stock-length perch/net night; Table 3). Since 2003, mean gill net CPUE values have fluctuated from a low of 0.0 (2005) to a high of 49.8 (2013; Table 2). Currently, relative abundance appears to be high.

Yellow Perch in the gill net catch ranged in TL from 9 to 32 cm (3.5 to 12.6 in; Figure 4). Based on ages obtained from otoliths, individuals from the 2011 year class, which were < quality-length (20 cm; 8 in), dominated the gill net catch (Figure 4). As a result, both the PSD and PSD-P were low (Table 1) and below the objective ranges of 30-60 and 5-10, respectively (Table 3).

In 2013, the weighted mean TL at capture of age-2 males was 151 mm (5.9 in); while females had weighted mean TL at capture of 163 mm (6.4 in) at age 2 (Table 7). The majority of yellow perch sampled were in the stock-quality length category which had a mean Wr of 103.

Other Species

Black bullhead: Relative abundance of Black Bullheads has been considered moderate to low in fish community surveys conducted from 2003-2010 (Table 2). In 2013, the mean frame net CPUE was 2.4 (Table 1) and within the management objective (≤ 100 stock-length Black Bullhead/net night; Table 3). Currently, relative abundance remains low and their impact on the fishery is likely minimal.

Northern Pike: Northern Pike typically are not sampled effectively during mid-summer fish community assessments. As a result, mean gill net CPUE values are often low. Northern pike relative abundance in Lake Alice has generally been considered moderate to low, with mean gill net CPUE values ≤ 2.3 in surveys conducted from 2003-2010 (Table 2). In 2013, the mean gill net CPUE of stock-length Northern Pike was 17.5 (Table 1) and indicated high relative abundance. High relative abundance can be attributed to increased recruitment likely related to substantial rises in spring water levels that took place from 2009-2011 (SDDENR 2014). Northern Pike depend heavily on flooded vegetation for spawning and recruitment, and tend to have improved recruitment during springs that have rising water levels.

Gill net captured Northern Pike ranged in TL from 39 to 71 cm (15.4 to 28.0 in), had a PSD of 63 and PSD-P of 1 (Table 1; Table 3; Figure 5). The condition of Northern Pike in the gill net catch was similar to that of Northern Pike captured from other northeast South Dakota lakes (e.g., Punished Woman Lake) with mean Wr values that ranged from 88 to 107 for all length categories (e.g., stock to quality) sampled. The mean Wr of stock-length pike was 89 (Table 1) and no length-related trends in condition were apparent.

Rudd: Rudd were first captured in Lake Alice in 1993 and have become well established. Since 2003, mean frame net CPUE values have ranged from a low of 0.8 (2005) to a high of 9.9 (2013; Table 2). In 2013, Rudd were the second most abundant fish species captured in the frame net catch (Table 1). Frame net captured Rudd ranged in TL from 17 to 42 cm (6.7 to 16.5 in), had a PSD of 66 and a PSD-P of 39; Table 1; Figure 6). Visual inspection of the length frequency suggested consistent recruitment as all cm-length groups from 17 to 42 cm were represented (Figure 6).

Rudd are an exotic fish species and all reasonable actions should be taken to prevent their spread to other waters. A ban on harvest of baitfish from Lake Alice should be continued and high predator (e.g., walleye) densities should be maintained in an attempt to impact the abundance of Rudd through predation.

Other: Common Carp, Green Sunfish, and White Sucker were other fish species captured in low numbers during the 2013 fish community survey (Table 1).

Management Recommendations

- 1) Conduct fish community assessment surveys utilizing gill nets and frame nets on an every third year basis (next survey scheduled in summer 2016) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Collect otoliths from Walleye and Yellow Perch; scales from Rudd to assess age structure and growth rates of each population.
- 3) Stock walleye (≈500 fry/acre) on a biennial basis to establish additional year classes.
- 4) Monitor water levels and winter/summer kill events. In cases of complete winter/summerkill, stock Northern Pike, Walleye, and Yellow Perch to re-establish a fish community.
- 5) Maintain a ban on harvest and/or transport of baitfish from Lake Alice to minimize the the spread of the invasive Rudd.

Table 1. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional size distribution of quality- (PSD) and preferred-length fish (PSD-P), and mean relative weight (Wr) of stock-length fish for various fish species captured in frame nets experimental gill nets from Lake Alice, 2013. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). BLB= Black Bullhead; COC= Common Carp; GSF= Green Sunfish; NOP=Northern Pike; RUD= Rudd; WAE= Walleye; WHS= White Sucker; YEP= Yellow Perch

Species	Abundance		Stock Density Indices				Condition	
	CPUE	CI-80	PSD	CI-90	PSD-P	CI-90	Wr	CI-90
<i>Frame nets</i>								
BLB	2.4	0.8	68	12	14	9	98	2
COC	0.2	0.1	100	0	33	67	108	75
GSF	0.1	0.1	0	---	0	---	108	---
NOP	2.9	0.8	88	7	6	5	84	2
RUD	9.9	5.0	66	6	39	6	---	---
WAE	0.2	0.2	100	0	75	59	84	3
WHS	0.2	0.2	100	0	100	0	100	9
YEP	10.3	4.9	5	3	5	3	88	<1
<i>Gill Nets</i>								
BLB	3.2	1.0	5	9	5	9	107	2
NOP	17.5	2.9	63	8	1	2	89	1
WAE	13.0	2.4	97	3	8	5	95	1
YEP	49.8	4.2	1	1	1	1	103	<1

Table 2. Historic mean catch rate (CPUE; catch/net night) of stock-length fish for various fish species captured in frame nets and experimental gill nets from Lake Alice, 2003-2013. BLB= Black Bullhead; BLG= Bluegill; COC= Common Carp; GSF= Green Sunfish; NOP= Northern Pike; RUD= Rudd; WAE= Walleye; WHS= White Sucker; YEP= Yellow Perch

Species	CPUE					
	2003	2004	2005	2007 ^{1,2}	2010 ²	2013 ²
<i>Frame nets</i>						
BLB	25.0	6.6	5.8	4.5	0.3	2.4
BLG	0.0	0.0	0.0	0.1	0.0	0.0
COC	0.0	0.0	0.2	0.6	0.6	0.2
GSF	0.1	0.0	0.1	0.3	0.1	0.1
NOP	0.3	0.2	0.2	0.5	0.7	2.9
RUD	4.8	4.0	0.8	3.9	2.2	9.9
WAE	0.3	0.6	1.2	3.9	2.9	0.2
WHS	0.0	0.8	0.1	0.2	0.2	0.2
YEP	0.0	0.0	0.0	0.1	1.2	10.3
<i>Gill nets</i>						
BLB	16.0	0.3	0.0	0.7	0.0	3.2
COC	3.0	0.3	0.0	2.7	0.2	0.0
GSF	0.0	0.0	0.0	0.0	0.0	0.0
NOP	2.3	0.5	0.0	0.7	0.7	17.5
RUD	0.0	0.5	0.0	0.7	0.0	0.0
WAE	0.2	2.5	1.0	24.0	0.8	13.0
WHS	0.2	0.8	0.0	0.3	0.2	0.0
YEP	1.7	2.2	0.0	1.5	9.8	49.8

¹ Monofilament gill net mesh size change (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

² Standard survey dates adjusted; conducted in late-June or early-July

Table 3. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish, and mean relative weight (Wr) for selected species captured in frame nets and experimental gill nets from Lake Alice, 2003-2013. BLB= Black Bullhead; NOP= Northern Pike; WAE = Walleye; YEP = Yellow Perch

Species	2003	2004	2005	2007 ^{1,2}	2010 ²	2013	Objective
<i>Frame nets</i>							
BLB							
CPUE	25	7	6	5	<1	2	< 100
PSD	23	100	100	53	100	68	---
PSD-P	17	90	100	49	100	14	---
Wr	92	111	108	93	99	98	---
<i>Gill nets</i>							
WAE							
CPUE	<1	3	1	24	1	13	≥10
PSD	0	60	50	100	80	97	30-60
PSD-P	0	47	0	1	20	8	5-10
Wr	---	86	87	98	85	95	
YEP							
CPUE	2	2	0.0	2	10	50	≥30
PSD	60	38	---	11	2	1	30-60
PSD-P	0	31	---	11	2	1	5-10
Wr	103	99	---	108	116	103	

¹ Monofilament gill net mesh size change (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

² Standard survey dates adjusted; conducted in late-June or early-July

Table 4. Year class distribution based on the expanded age/length summary for walleye sampled in gill nets and associated stocking history (# stocked x 1,000) from Lake Alice, 2007-2013.

Survey Year	Year Class										
	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
2013 ¹			2		71				1	3	
2010	---	---	---		36				1	3	
2007 ^{1,2}	---	---	---	---	---	---			7	132	3
# stocked											
fry	575		500		575		1,100		1,150	1,500	1,200
sm. fingerling										230	
lg. fingerling											

¹ A single walleye from the 1997 year class was sampled, but is not reported in this table

² Monofilament gill net mesh size (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

Table 5. Weighted mean length at capture (mm) for walleye age-1 through age-10 captured in experimental gill net sets (expanded sample size) from Lake Alice, 2007-2013. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

Year	Age									
	1	2	3	4	5	6	7	8	9	10
2013 ¹	---	328(2)	---	470(71)	---	---	---	589(1)	588(3)	---
2010	204(36)	---	---	---	464(1)	531(3)	---	---	---	---
2007	---	418(7)	447(132)	496(3)	---	---	---	---	---	590(1)

¹ Older Walleye were sampled, but are not reported in this table

Table 6. Stocking history including size and number for fishes stocked into Lake Alice, 2003-2013.

Year	Species	Size	Number
2003	WAE	fry	1,200,000
2004	WAE	fry	1,500,000
	WAE	fingerling	229,700
2005	WAE	fry	1,150,000
	YEP	fingerling	1,000
2007	WAE	fry	1,100,000
2009	WAE	fry	575,000
2011	WAE	fry	500,000
2013	WAE	fry	575,000

Table 7. Year class distribution based on the expanded age/length summary for yellow perch sampled in gill nets from Lake Alice, 2010-2013.

Survey Year	Year Class						
	2013	2012	2011	2010	2009	2008	2007
2013		21	296	1	2		
2010	---	---	---		58		1

Table 8. Weighted mean total length (mm) at capture by gender for yellow perch captured in experimental gill nets (expanded sample size) from Lake Alice, 2010-2013. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

Year	Age			
	1	2	3	4
2013				
Male	106(6)	151(94)	---	---
Female	109(13)	163(196)	297(1)	328(2)
Combined	108(21)	159(296)	297(1)	328(2)
2010				
Male	154(8)	---	---	---
Female	162(49)	---	266(1)	---
Combined	161(58)	---	266(1)	---

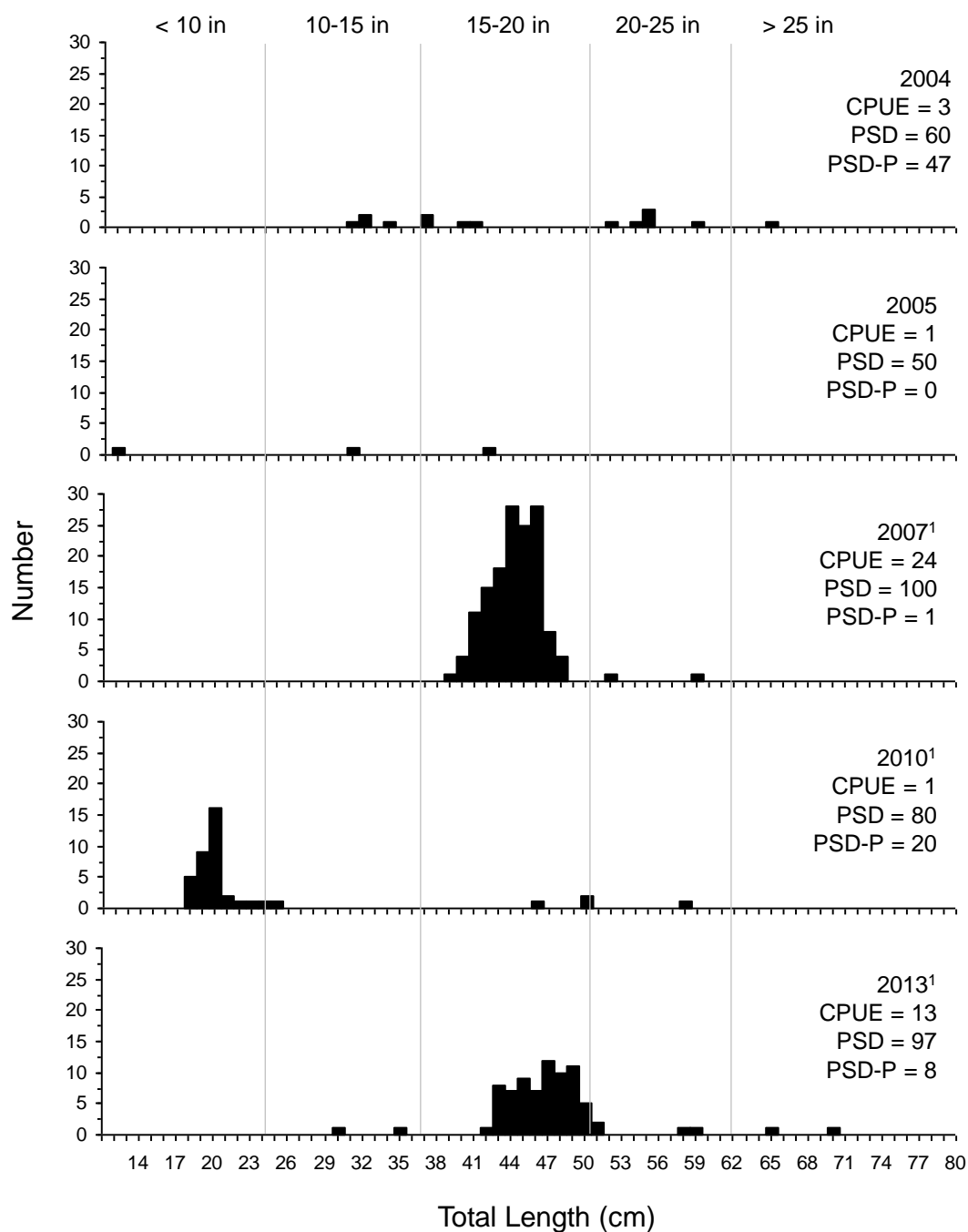


Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Walleye captured using experimental gill nets in Lake Alice, 2004-2013.

¹ Standard survey dates adjusted; conducted in late-June or early-July.

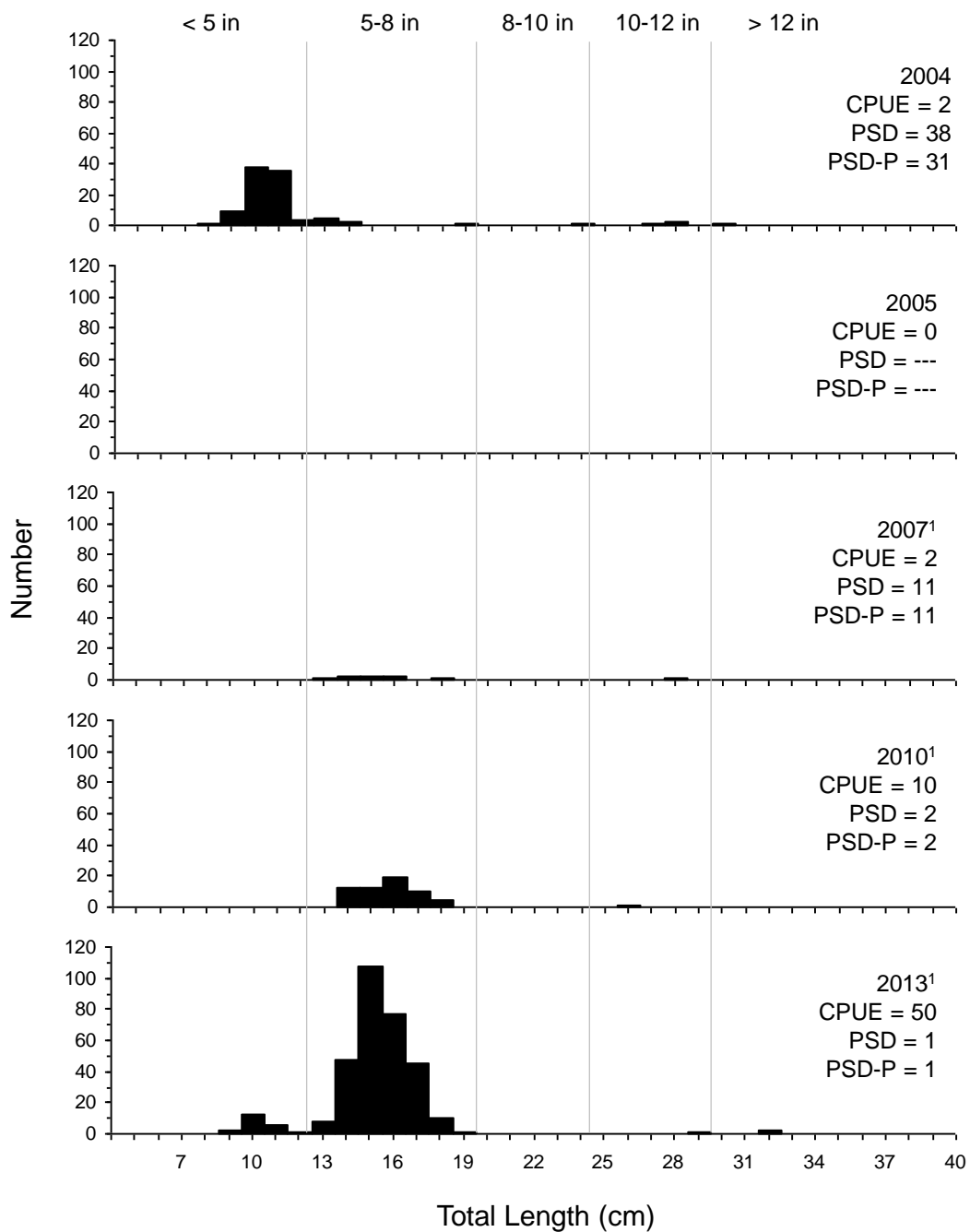


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Yellow Perch captured using experimental gill nets in Lake Alice, 2004-2013.

¹ Standard survey dates adjusted; conducted in late-June or early-July.

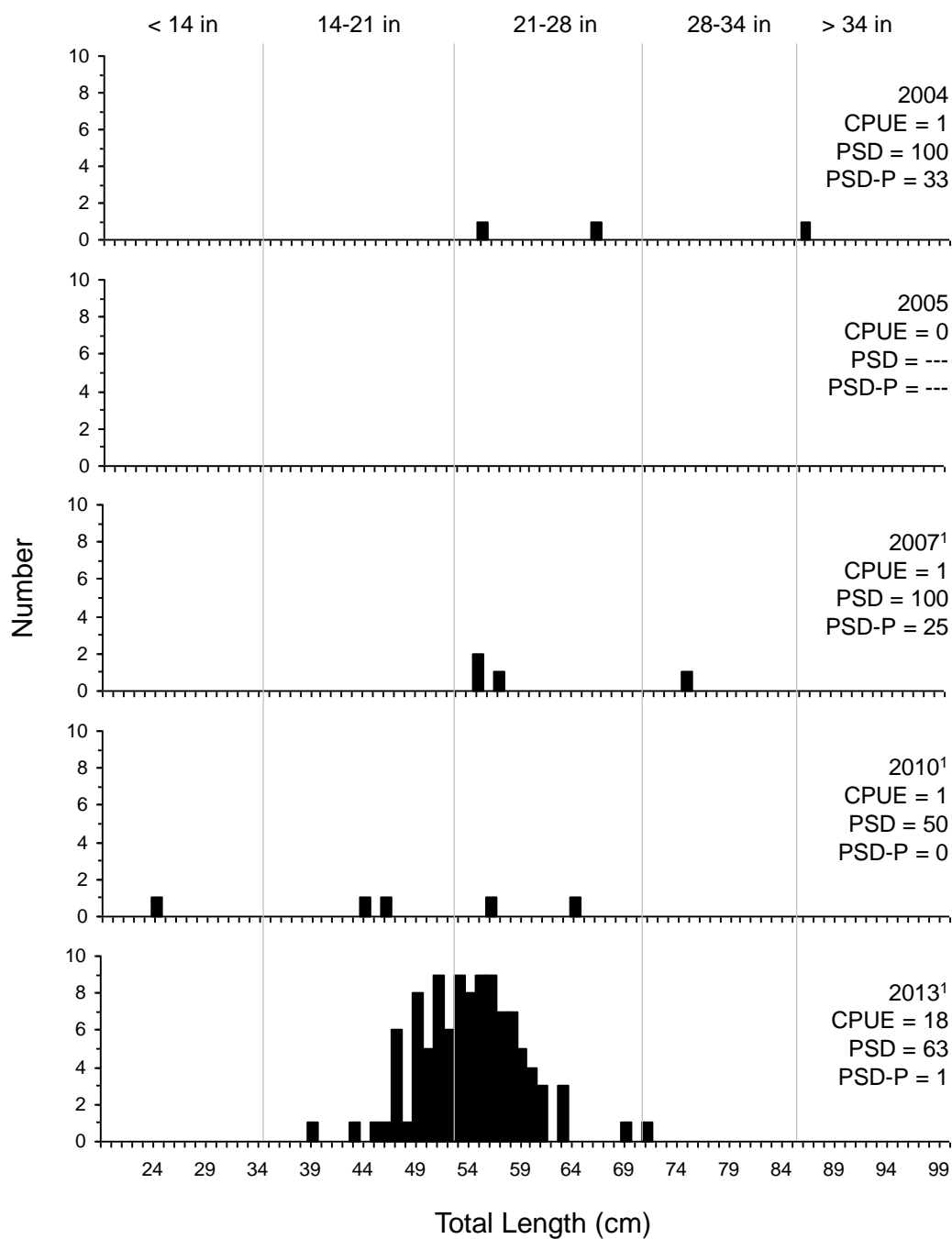


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Northern Pike captured using experimental gill nets in Lake Alice, 2004-2013.

¹ Standard survey dates adjusted; conducted in late-June or early-July.

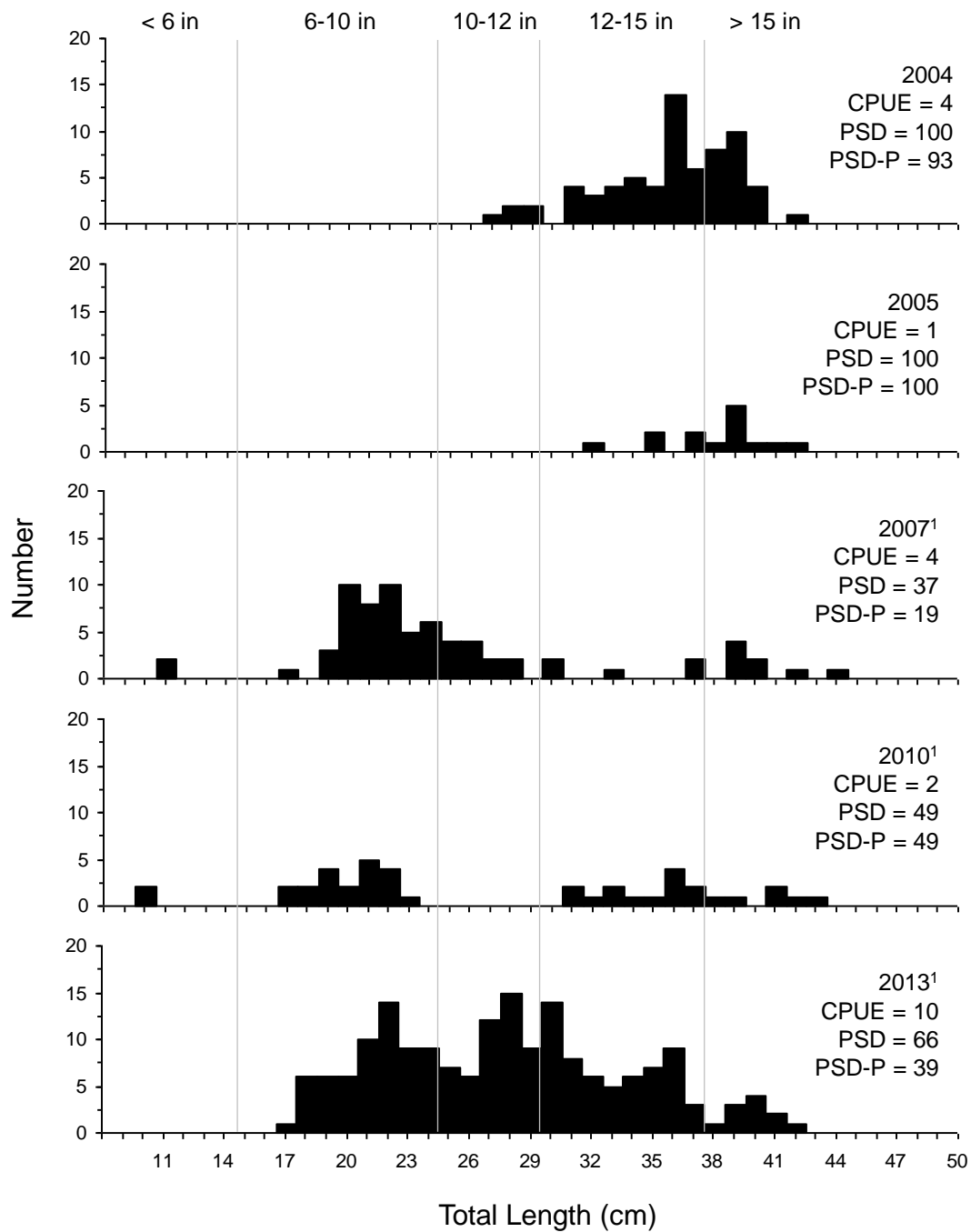


Figure 6. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Rudd captured using frame nets in Lake Alice, 2004-2013.

¹ Standard survey dates adjusted; conducted in late-June or early-July.